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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

Reply to
Attn of: WCM-121

JUL 02 2002

MEMORANDUM

SUBJECT: Region 10 Comments on the Draft Report of 4/30/2002 to Evaluate "Treatment Technologies for Historical Ponds Containing Elemental Phosphorus - Summary and Evaluation"

FROM: Michael F. Gearheard, Director
Office of Environmental Cleanup

TO: Walter W. Kovalick, Jr., Ph.D., Director
Technology Innovation Office

Thank you for providing Region 10 an opportunity to review and comment on the draft report. In the enclosed attachment we have provided some general and specific comments. I do not want to summarize our comments in this cover memo, however, I would like to point out our two primary concerns:

1. The cost estimates for the six technologies were not carried out in a way that provides a consistent basis for comparison, especially in regard to the chemical oxidation system that was being constructed on-site. The costs do not reflect complete treatment system requirements and costs are therefore, underestimated.

2. The treatment of risk is incomplete, and it is not made clear in the report that the minimal reduction of risk to the environment is not commensurate with the short term risk posed by handling the waste (especially given the potential costs of these technologies).

If you have any questions regarding these comments please contact Linda Meyer of my staff at (206) 553-6636.

Attachment

cc: Gil Haselberger,
Andy Boyd, ORC
Charles Ordine, ORC
Dave Croxton, ECL
Michele Pirzadeh, ECL

7/1/2002

EPA Region 10 Comments on Technology Innovation Office Draft Report of 4/30/2002: "Treatment Technologies for Historical Ponds Containing Elemental Phosphorus - Summary and Evaluation"

GENERAL COMMENTS

Generally the report summarizes technologies and studies that the Region was aware of that existed at the time the Superfund and RCRA decisions were made to proceed with capping with waste in place. Since that time, however, the selection of in-situ stabilization/solidification for waste at the Tarpon Springs site has occurred. It is our understanding that the levels of elemental phosphorus at this facility are in the 100's of ppm not the 10,000's as is the case with FMC. This is a substantial difference from a treatment technology perspective since the rate of reaction and subsequent management of the generation of toxic gases is a critical element to treatment of elemental phosphorus-containing wastes.

The costs that are provided for these various systems do not allow for consistent comparisons. The report only evaluated the order of magnitude cost for one specific element of treatment and did not provide an estimate for a complete treatment system. The costs stated for the chemical oxidation treatment system that was being constructed on-site prior to the plant shutdown last year were for both the chemical hydrolysis and off-gas treatment (destruction of the converted waste). The chemical oxidation system converts the waste to phosphine, which requires destruction or further treatment. The cost for the entire system is included, which makes comparison to other systems – where full system costs are not provided – difficult. A number of the treatment technologies reviewed would require the same system; i.e., a chemical conversion step followed by treatment of the waste in a gaseous form (indicated in the table below as treatment of converted waste). To only consider a portion of the cost is not reflective of the entire costs. In addition, some of the technologies are sensitive to properties of the feed and would require pre-processing in order to adequately react the phosphorus. From experience at the Tarpon Springs site, and experiences with gases currently being generated at Pond 16S at FMC, containment of gases would be essential for any in-situ treatment. Treatment of this waste generates phosphine or hydrogen cyanide gas which would be required to be collected, even in the outside environment; this is included in the table under ambient gas control. Gases generated while excavation is conducted may be an issue and require some level of control or monitoring; however, they are less of a concern than the gases which could be emitted during in-situ treatment. As the report indicates, many of these technologies adjust the pH, making metals more soluble and requiring final disposal as hazardous waste. The following table identifies the relevant treatment steps (with X designating the applicable components) that should be included in the final cost for the technology. These costs should be included so the options are comparable.

Technology	Excavation	Pre-processing	Treatment of Converted Waste	Ambient Gas Control	Solids Disposal
In-Situ Stabilization				X	
Caustic Hydrolysis	X	X	X		X
Chemical Oxidation	X	X		X	X
Ex-Situ Mechanical Aeration	X	X		X	X
In-Situ Mechanical Aeration			X		
Incineration	X				X
Thermal Desorption	X	X		X	X

SPECIFIC COMMENTS

Page 1, Third paragraph: The facility is no longer owned by Astaris. The current owner and operator is FMC, LLC Idaho.

Page 7, Last paragraph: This paragraph identifies issues that this report does not address, including risk to human health and the environment posed by the ponds, and how a technology would reduce risk. This assessment is essential to assess the potential effectiveness of any remedy. The risks posed by elemental phosphorus are unique and quite different from the risks posed by metals and even radionuclides. In several instances, the report refers to the ability of the technology to reduce the mobility of elemental phosphorus to the groundwater. In evaluations that Region 10 has conducted in the past, the risk posed to the groundwater has been evaluated by collecting elemental phosphorus data from groundwater monitoring wells down-gradient of the ponds. There has been no indication that elemental phosphorus is migrating from the surface impoundments or historic pond areas. The risk to human health and the environment which elemental phosphorus poses is due to either direct contact with the waste or exposure of the waste to oxygen or water which creates hazardous by-products which could result in direct exposure or inhalation. These risks are the basis for selecting a remedy to address elemental phosphorus. If the identified technology can only partially treat elemental phosphorus, the risks are not reduced;, in fact, partial in-situ treatment can cause a greater short term risk due to the increased emissions. The document should either address this component of the risk in the technology performance section of the evaluations, or remove references to reducing the mobility of elemental phosphorus to groundwater.

Page 30, Chemical Characteristics: In addition to elemental phosphorus, metals, and radionuclides, the RCRA ponds emit hydrogen cyanide at lower pH levels. This constituent of concern should be included in the description of chemical characteristics.

Page 34, Third Paragraph, last sentence: There is no surface water hydraulically connected to the ponds.

Page 34, Fourth Paragraph: The conclusion that, because the hydrolysis reaction is slow and there would be dilution from outside air in the atmosphere, there would be low, insignificant concentrations of gas has not been proven, at least in regard to the closure that has been conducted at RCRA Pond 16S. A temporary cover has been placed over this Pond as Phase 1 of the RCRA closure, and phosphine continues to be generated at levels of concern in the vicinity of the pond. These gases are currently being extracted from under the cover and treated in a carbon adsorption system. It appears that the unit had lime which may have not been adequately reacted with the elemental phosphorus prior to placing the cap. The reaction is continuing to generate phosphine. Adequate and complete mixing is an important factor to consider for any in-situ process. It should be noted in this paragraph that, while the hydrolysis reaction is important in generating phosphine, phosphine generation is controlled to a great extent by pH and temperature.

Page 48, Engineering Considerations: This section should acknowledge that emission controls (in addition to respiratory protection for worker safety) would be necessary to control releases of phosphine and phosphorus pentoxide from the excavation area. The Tarpon Springs Removal project entailed excavating sludge material from a condenser sump and required the use of a metal containment structure with air scrubbers to address emissions. Based on experience from the Tarpon Springs Site, it is very likely that a similar system would be required for excavation given the concentrations of elemental phosphorus at the historic pond areas. This control should be factored into the excavation technology.

Page 50, Solidification/Stabilization (S/S): The section regarding available data which references selection of S/S at the Tarpon Spring site should include relevant site data to allow an understanding of how comparable the two sites are. The report states that the radionuclide levels are different, but that does not help in understanding the applicability of the technology to treat elemental phosphorus. The concentrations of elemental phosphorus, amount of metals, and type of structure or containment cell the material is in should be provided.

Page 53, Caustic Hydrolysis: While it is noted in the technology description that, in addition to the caustic hydrolysis (chemical treatment), this system included a thermal treatment unit, this unit was subject to the RCRA combustion standards. The performance section of this report states that this technology is robust. While caustic hydrolysis in general may be robust, the treatment system (caustic hydrolysis and combustion unit) together would not be considered "robust." To ensure adequate destruction of hydrogen cyanide and a controlled rate of phosphine feed going to the combustion unit, the caustic hydrolysis had to be tightly controlled. To ensure metal emission rates from the combustion units were maintained within the proposed permitted standards the soil or non-phosphorus fraction of material fed to the system required close monitoring. This system was designed to treat a waste stream with consistent, homogeneous properties.

Page 55, Cost, Third sentence: The statement that this plant could be used for treatment of material in non-CERCLA ponds (15S, 16S, and phase IV) should be removed. The system was designed for treatment of plant waste which was generated in a slurry form. It was also designed to treat Pond 18 waste. Excavation of the wastes from these units would be difficult since they include containerized waste and debris. The material from these ponds would require extensive pre-processing prior to being fed to the LDR system.

Page 59, Chemical Oxidation, Engineering Consideration: The Region's experience with this waste is that, in lowering the pH, hydrogen cyanide is emitted at levels of concern. This should be identified as an issue for consideration in designing or operating a chemical oxidation system.

Page 59, Engineering Consideration, third paragraph, fourth sentence: This sentence states that the residual could be disposed of as a by-product. We think that the residual should be considered as hazardous waste needing disposal. Disposal costs could be potentially avoided if the material met the specifications for fertilizer, but it is unclear what the by-product is. Since this information is being used in an order- of-magnitude cost estimate, it should be assumed the final material is a hazardous waste and requires disposal.

Page 60, Chemical Oxidation, Cost: The last sentence should include a statement that chemical oxidation would likely involve additional costs for emission controls since phosphine and/or phosphorus pentoxide will be a by-product of oxidation and require destruction or conversion.

Page 60, Mechanical Aeration, Mechanism: This section should state that aeration will convert elemental phosphorus to phosphine or to phosphorus pentoxide, which will require emission controls.

Page 61, First Paragraph, last sentence: This sentence states that ex-situ aeration would generate hazardous off gases. This is true for in-situ treatment also, but the emissions would be much more difficult to control since the reaction would not be in a controlled, engineered environment.

Page 61, Mechanical Aeration, Performance: This section should include information regarding the level of elemental phosphorus in solids used in studies conducted by USACE. Many of the studies conducted by USACE which the Region researched were not relevant to the high levels of elemental phosphorus found at FMC. One application of technologies which USACE was evaluating was to bombing ranges in wetlands at Eagle River Flats in Alaska. The residual particles of elemental phosphorus were of significantly less volume and concentration and could be safely oxidized. For the reader to evaluate the applicability of the tested technology to FMC's material, details of the application should be included in this report.

Page 71, First Paragraph, Second sentence: This sentence states that residuals from treatment such as solid, liquid, or gaseous residues would require further management, which is misleading. Since elemental phosphorus is very unstable, many of the technologies convert elemental phosphorus from a solid to a gas. This gas then requires further treatment which is more than just residual management. The gas requires scrubbing which was a significant portion of the cost for the LDR treatment system. The reader is left to believe that this component of the remedy is an incidental cost when, in reality, it may be as expensive as the main treatment cost. In addition, scrubbing phosphorus pentoxide to reach acceptable discharge levels, while not impossible, is technically challenging.